



Maintaining a Healthy, Safe and Secure Work Environment

An accident can occur anywhere or everywhere if we do not follow or maintain a secure environment. Accidents occur due to improper handling of tools, machine or equipment. The fatal injury rate for the construction industry is higher than the national average in this category for all industries. “About 48,000 workers die in India due to occupational accidents, of which 38 fatal accidents take place every day in the construction sector. Construction industry contributes to 24.20% of occupation fatalities, the highest in the country annually,” the British Safety Council (BSC) has said. Construction sector is the number one sector employing maximum number of employees. It is important to that workers are oriented about hazards and their controlling them.

Within the plumbing industry, the plumber may be involved in a range of work activities, such as,

1. installing hot water and gas services,
2. replacing guttering and downpipes,
3. laying and connecting water and sewage pipes and
4. fixing washbasin or sewage blockage.

Hazards to the Plumber

1. Use of powered tools
2. Use of hand tools
3. Falls
4. Manual handling
5. Hazardous substances
6. Biological hazards
7. Electricity
8. Burns
9. Trenches and confined spaces
10. Sunburn and heat stress
11. Scaffolding

Use of Power Tools

Power tools are used to carry out everyday tasks in the plumbing industry. Power tools are operated by an additional power source, using electric motors, engines, compressed air, etc. These can present serious risks if not used and maintained correctly. The most common injury that can occur while using power tools is to the hands and fingers, which could get cut, broken or crushed. Eye injuries are often caused by pieces of material flying off while being cut or ground by power tools. Such injuries can lead to long periods away from work and sometimes result in permanent disability. Some commonly used power tools include air compressor, pneumatic wrench, power drill machine, etc.



Fig. 6.1: Using power drill machine

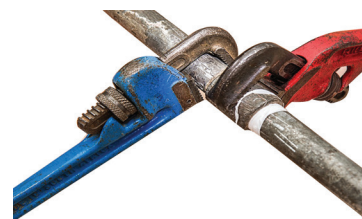
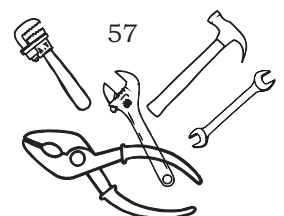


Fig. 6.2: Hand Tool

Use of Hand Tools

These tools are manually operated and do not rely on a power source. Some commonly used hand tools include hammers, pliers, monkey wrenches, etc. These can also be dangerous if they are not used correctly. A common cause of accidents with hand tools is using the wrong tool for the job. For instance, if one uses a wrench for hammering work then it may hit one's fingers and cause injury. Thus, one should use hammer in place of a wrench.

MAINTAINING A HEALTHY, SAFE AND SECURE WORK ENVIRONMENT



It is important for the plumber to wear the appropriate personal protective equipment (PPE) in order to protect oneself.

The personal protective equipment includes safety glasses or goggles, earplugs or earmuffs, protective gloves, overalls or other close fitting clothing. Safety shoes or boots with reinforced toe-caps will protect one's feet if any heavy or sharp items are dropped.

Falls

Many plumbing tasks are carried out at varied heights and depths. These include plumbing work on roofs,

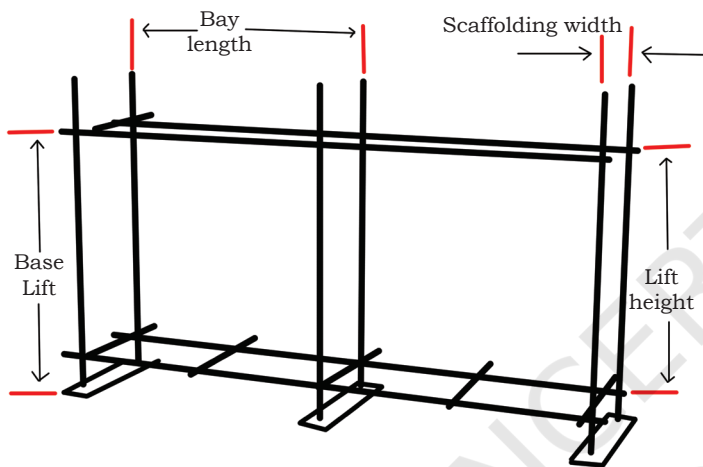


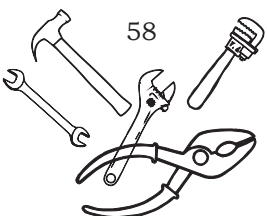
Fig. 6.3: Fall

installing or repairing gutters and downpipes, accessing roof cavities through manholes, etc. Safe work methods must be established before a worker is required to access the task. The options for work at height (in their preferred order) are as follows.

1. Use fall protection devices (such as temporary work platforms or scaffolding)
2. Use a work positioning system (such as a rope access system to position and support the worker for the duration of the task)
3. Use a fall injury prevention system (such as an industrial safety net or a safety harness)
4. Use a ladder, as long as it can be employed safely for the duration of the task. This will require procedures and training for the workers who will use it.

Protection from falls

Each year, falls consistently account for the greatest number of fatalities in the construction industry. A number of factors are often involved in falls, including unstable working surfaces, misuse or failure to use fall protection equipment and human error. Using guardrails, fall arrest systems, safety nets, covers and



restraint systems can prevent many deaths and injuries from falls.

Precautions

- (i) Aerial lifts or elevated platforms should be considered to provide safer elevated working surfaces
- (ii) Erect guardrail systems with toe boards and warning lines or install control line systems to protect workers near the edges of floors and roofs
- (iii) Cover floor holes; and/or use safety net systems or personal fall arrest systems

Ladders

Ladders and stairways are another source of injuries and fatalities among construction workers. Injuries could occur due to bad quality ladder, loose ladder and narrow or steep, slippery stairways.

Precautions

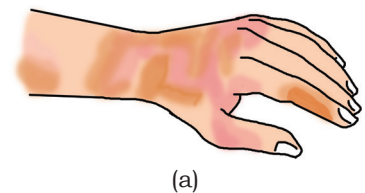
- (i) Use a ladder which is strong for the task.
- (ii) Make sure that ladders are long enough to safely reach the work area.
- (iii) Mark or tag ('Do Not Use') damaged or defective ladders for repair or replacement, or destroy them immediately.
- (iv) Never load ladders beyond the maximum intended load or beyond the manufacturer's rated capacity.
- (v) Ensure that the load rating can support the weight of the user, including materials and tools.
- (vi) Avoid using ladders with metallic components near electrical work and overhead power lines.

Stairways

Slips, trips and falls on stairways are a major source of injuries and fatalities among the construction workers.

Precautions

- (i) Stairway treads and walkways must be free of dangerous objects, debris and materials.
- (ii) Slippery conditions on stairways and walkways must be corrected immediately.

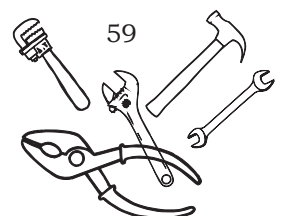


(a)



(b)

Fig. 6.4 (a) Acid injury on hands, (b) Fire hazard



- (iii) Make sure that treads cover the entire step and landing. The treads should be made enough wide so that there is no slipping. Stairways having four or more risers or rising more than 30 inches must have at least one handrail.

Manual Handling

A plumber's work often involves significant manual handling hazards. Handling heavy objects and moving them, often in uncomfortable postures because of lack of space to move freely, creates a risk of traumatic injury, such as a strained back. The need for continuous repetitive movements can lead to injuries due to exertion, affecting the neck, back, hand and arms over a period of time. Work should be arranged and monitored to minimise the risk of overuse injuries.

Hazardous Substances

Hazardous substances are chemicals used to carry out work, or present in the work environment. All of these may create hazards for plumbers if their use in the workplace is not managed with care. These hazardous substances may be Oxy-acetylene, Fluxes (solder), Lead, Hydrochloric acid, Degreasers and solvents, Adhesives or Caulking compounds.

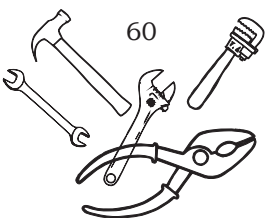
Biological Hazards

Health effects of exposure to sewage include tetanus (caused by a toxin produced by a bacteria common in soil and sewage), leptospirosis (caused by a parasitic worm), hepatitis A, and parasites, such as giardia and cryptosporium. The degree of harm that can result depends on the microbes present, and the extent and duration of exposure. Microbes in raw sewage can enter the body through the nose or mouth, particularly if a person drinks contaminated water or by hand-to-mouth transmission.

1. Assume anything touched by sewage as contaminated.
2. Do not eat or drink in any sewage handling area.
3. Wash hands well with soap and clean water, preferably hot, before eating or drinking, and



Fig. 6.5: Inhalation hazard sign



after touching any surface or object that may be contaminated by sewage.

4. Immediately wash and disinfect any wound that comes in contact with sewage.
5. Change out of work clothes before leaving the work site (soiled work clothes should be bagged and laundered separately from other clothing).
6. Wear appropriate protection. This includes rubber boots and gloves, overalls and eye protection (wear goggles if a hose is being used, as safety glasses will not protect against splashing).

Electricity

Electric leads must be kept away from water. Because plumbers use powered tools in proximity to water supply in all weather conditions, there is always the possibility of electrocution if work practices do not take into account the presence of electrical hazard. Insulated hot water pipes with 240-volt heat trace cables are used to maintain water temperature in many modern apartments. If power to the heat trace cable is not isolated, there is potential for electrocution when a plumber unknowingly cuts through the insulated pipe. Simply turning off the water supply valve will not shut down the power to the cable but the power supply should also be shut down.



Fig. 6.6: Electric plug

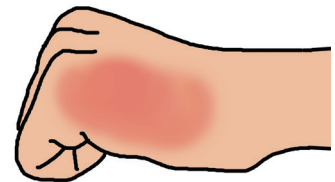


Fig. 6.7: Burn on hand

Burns

Hot water services store water at high temperatures. Maintenance and repair work must be carried out carefully to avoid scalds and steam burns. The unexpected release of hot water or steam could result in serious injury and permanent disfigurement.

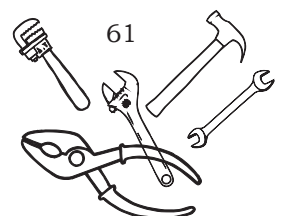
Trenches and Confined Spaces

Plumbers working in trenches, pits, tanks, beneath houses and in roof cavities must understand and plan for the significant hazards in confined spaces. In sewage systems, the release of toxic gases can cause the plumber to collapse, become unconscious and die. Before any



Fig. 6.8: Hazardous Toxic Gas

MAINTAINING A HEALTHY, SAFE AND SECURE WORK ENVIRONMENT



worker begins a job in a confined space (such as a pit or tunnel) where hazardous gases could be present or oxygen may be deficient, there must be a full assessment of the worksite and the safeguards required.

Trenching

Trench collapses cause dozens of fatalities and hundreds of injuries each year.

Precautions

- (i) Never enter an unprotected trench.
- (ii) While entering a trench, proper support like ladder, ropes, oxygen cylinder, goggles, etc., should be provided to the worker at a certain interval of depth.
- (iii) Employ a registered professional engineer to design a protective system for trenches 20 feet deep or greater.
- (iv) Always provide a way to exit a trench, such as a ladder, stairway or ramp—no more than 25 feet of lateral travel for employees in the trench.
- (v) Keep soil at least two feet behind the edge of a trench.
- (vi) Make sure that trenches are inspected by site engineer prior to entry and after any hazard-increasing event, such as a rainstorm, vibrations or excessive surcharge loads.



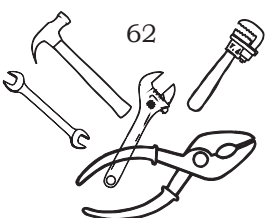
Fig. 6.9: Blisters due to Sunburn

Sunburn and Heat Stress

Workers who are exposed to extreme heat or work in hot environments may be at risk of heat stress. Heat stress can result in heat stroke, heat exhaustion, heat cramps, or heat rashes. Heat stress, sunburn and skin cancer can all result from prolonged exposure to ultraviolet radiation from the sun. The longer the skin is exposed, the greater the risk, regardless of tan or skin pigment.

Scaffolding

A scaffold is a temporary structure made of bamboo or iron pipe to support workers to carry out the work. When scaffolds are not erected or used properly, fall hazards can occur.

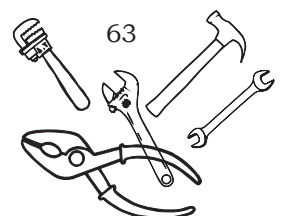


Precautions

- (i) Scaffold must be sound, rigid and sufficient to carry its own weight, plus four times the maximum intended load without settling or displacement. It must be erected on solid footing.
- (ii) Unstable objects, such as barrels, boxes, loose bricks or concrete blocks must not be used to support scaffolds or planks.
- (iii) The scaffold must not be erected, moved, dismantled or altered except under the supervision of person who supplies, installs and dismantles the scaffolding.
- (iv) The scaffold must be equipped with guardrails, mid rails and toe boards.
- (v) Scaffold accessories, such as braces, brackets, trusses, screw legs or ladders that are damaged or weakened must be immediately repaired or replaced.
- (vi) Scaffold platforms must be tightly planked with scaffold plank grade material or equivalent. A plank is timber that is flat, elongated and rectangular with parallel faces that are high and long.
- (vii) Synthetic and natural rope is used in suspension scaffolding, that is a hanging-type scaffolding. It must be protected from heat-producing sources.
- (viii) The scaffold can be accessed by using ladders and stairwells.
- (ix) The scaffolds must be at least 10 feet from electric power lines at all times.

Safety Check

For quality control of any work, a checklist for safety is prepared. A checklist is a list of items you need to verify, check or inspect. Checklists are used in every imaginable field—from building inspections to complex medical surgeries. Using a checklist allows you to ensure that you do not forget any important steps. These checklists are prepared for office work, construction site, handling of equipment, etc. These checklists are available with the user and agencies. This checklist should be followed



in routine practice to maintain standard and quality. Adoption of these checklists will reduce accidents and hazards.

Precautions at Workplaces

For safe operation, following precautions should be ensured at the workplace.

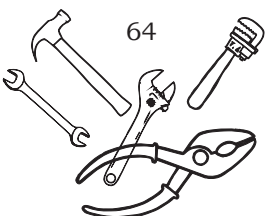
- (a) Precautions must be taken against a person falling from a working platform erected at various heights in a building.
- (b) Protection against structural collapse (while work is taking place) i.e., the building falling down.
- (c) Safeguards to be used when a person is working in excavations like well or mines.
- (d) Care should be taken to prevent drowning (falling into water).
- (e) Steps should be made for safe traffic routes (on sites) to avoid accidents.
- (f) Prevention and control of emergencies services (site emergency evacuation procedures, etc.).
- (g) Provision of welfare facilities—washroom, washing facilities, canteens/rest areas, shower facilities, (if required).
- (h) Provision of site-wide issues—clean and tidy sites, adequate lighting, constant and fresh air supply, etc.
- (i) Training, inspection and reports—training of staff, use of trained staff to do the work, supervision of staff and monitoring the work carried out to ensure it is carried out in a safe manner.

Reporting of Injuries, Diseases and Danger

For better working conditions in a factory or industry, it is necessary to record and report the injuries, diseases and danger that occur to a worker or employee. Special care should be taken to avoid dangerous occurrences like collapse of building, excavation, etc. It is always advisable to maintain an accident book document, where detail of all accidents is recorded, no matter how minor. Moreover following points should be also checked.

1. Maintain a Material Safety Data Sheet (MSDS) for each chemical in the facility. Make this

PLUMBER (GENERAL) – CLASS X



information accessible to employees at all times in a language or format that is clearly understood by all personnel.

2. Train employees on how to read and use the MSDS.
3. Follow the manufacturer's MSDS instructions for handling hazardous chemicals.
4. Train employees about the risks of each hazardous chemical being used.
5. Provide spill clean-up kits in areas where chemicals are stored.
6. Have a written spill control plan.
7. Train employees to clean up spills, protect themselves and properly dispose of used materials.
8. Provide proper personal protective equipment and enforce its use.
9. Store chemicals safely and securely.

Signs and Symbols on Site

Sign and symbols are used to inform and alert the people on all aspects. Some common safety symbols are discussed here.

- Circular red borders along with a cross bar and black symbols on a white background indicates what must not be done like 'No Smoking'
- White symbol on blue background indicates what must be done like 'Wear Eye Protection'
- Triangular yellow background with a black border and symbol inside warns of hazard or danger, for example, 'Danger Electric Shock Risk'
- Square or rectangular white symbols on a green background indicates or gives information on safety provision like 'First Aid Facilities'.

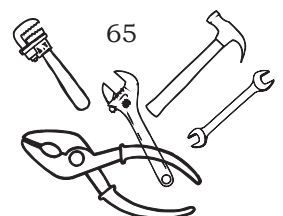
Personal Protective Equipment at Work (PPE)

It is defined as any equipment (including clothing affording protection against the weather), which is intended to be worn or held by a person at work, and which protects them against one or more risks to their health.



Fig. 6.10: Safety symbols

MAINTAINING A HEALTHY, SAFE AND SECURE WORK ENVIRONMENT



Safety Equipment



Fig. 6.11: Eye protection



Fig. 6.12: Hand protection



Fig. 6.13: Head protection



Fig. 6.14: Boot

(a) Eye protection: It comes in the form of

- (i) Safety glasses—a typical application could be during lead welding
- (ii) Safety goggles—these provide a higher level of protection than safety glasses, as they fit closely to the face
- (iii) Welding goggles—these include specialist coloured lenses.

(b) Hand protection: It is usually used in plumbing and includes the following.

- (i) General-purpose gloves—these help protect against cutting or puncture, wounds; an example of their use could be lifting concrete blocks or lifting steel tube.
- (ii) Specialist gloves—these are typically used to deal with hazardous substances, such as dry ice used in pipe-freezing applications.
- (iii) Rubber gloves—these help protect against contact with waste systems and sanitary appliances. Gloves also provide protection against a disease known as dermatitis, which is caused by the hands coming in contact with materials classified as irritants.

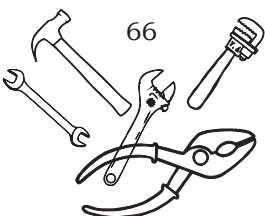
(c) Head Protection: Such injuries occur when we are not prepared to protect our head. Serious head injuries can get fatal.

It is a mandatory requirement to wear a safety helmet when working on construction sites of multistorey buildings or commercial housing, industrial building construction etc. In addition, a safety helmet needs to be worn while working at heights or in a trench.

A safety helmet must

- (i) be properly adjusted to fit.
- (ii) be replaced if it becomes defective or damaged.

(d) Foot protection: It is necessary to protect foot from injuries caused during plumbing installation work. It is necessary for workers to wear the standard safety boots.



(e) Ear protection: It is used while working in noisy areas or with equipment that generate high levels of noise. Ear protection gear includes:

- (i) Ear defenders
- (ii) Ear plugs

(f) Respiratory protection: When there is dust at workplace, the efficiency of workers gets affected, hence, it is necessary to use respiratory protection system. Some important respiratory equipment are.

- (i) Simple dust mask—this mask is used against normal pollution dust, etc.
- (ii) Cartridge-type respirator—these masks can guard against a range of substances, such as high levels of dust or fumes; different disposable cartridges are required to protect against different types of substances.
- (iii) Full breathing apparatus—usually used in specialist work in confined spaces, such as drains or sewers.

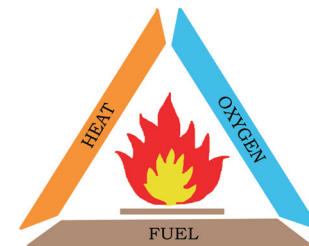


Fig. 6.15: Respiratory protection

Fire

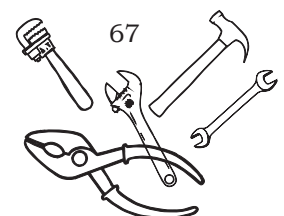
Fire is classified into groups according to the type of fuel

- (i) Class A—fires involving solid materials, extinguished by water
- (ii) Class B—fires involving flammable liquids, extinguished by foam or carbon dioxide
- (iii) Class C—fires involving flammable gases, extinguished by dry powder
- (iv) Class D—fires involving flammable metals, extinguished by dry powder

Fire-fighting Equipment

There is a variety of different types of fire fighting equipment. In undertaking plumbing work you are more likely to come across the fire extinguisher as the main source of protection; following are the steps to use a fire extinguisher.

- (i) An extinguisher should be kept in the immediate work area when not working
- (ii) A fire extinguisher should only be used when it is safe to do so. Personal safety must come before attempts to contain a fire



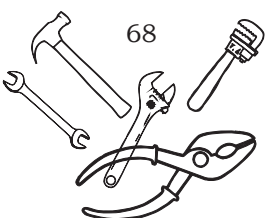
- | Type of extinguisher | Colour code | Main use |
|----------------------|-------------|---------------------------------------|
| Water | Red | Wood paper or fabrics |
| Foam | Cream | Petrol oil, fats and paints |
| Carbon oxide | Black | Electrical equipment |
| Dry powder | Blue | Liquids, gases, electrical equipments |

During an emergency period, the following actions should be taken

- ## Summoning the Emergency Services

- (d) Employers and the self-employed need to assess the first aid requirements of their work
- (e) Make sure there are enough trained first aiders and facilities to help casualties of illness or injury immediately, and that an ambulance or other professional help can be summoned without delay.

Fig. 6.16: First Aid box



items help provide the patient immediate relief from pain or injury.

- (a) Plasters
- (b) Sterile dressings
- (c) Triangular bandage
- (d) Safety pins(sling)
- (e) Disposable gloves
- (f) Crepe bandages
- (g) Scissors, tweezers
- (h) Cotton wool tap/faucet
- (i) Alcohol-free antiseptic wipes
- (j) Sterile pads

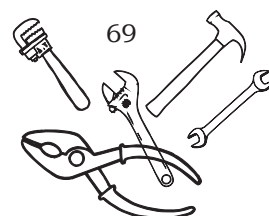
First aid assessment should take into account:

- (a) The nature of the work
- (b) The history and consequences of injuries
- (c) The nature and distribution of the workforce
- (d) The remoteness of the site from the emergency services, including location, terrain and weather conditions
- (e) Working on shared or multi-occupied sites
- (f) Holidays and other absences of first aiders
- (g) The presence of trainees and the public
- (h) The possibility of medical conditions or allergies

Safety Guidelines

Step 1 – Identify potential causes of workplace injury and illness

- (i) Does the nature of the work being carried out pose a hazard to people's health and safety?
- (ii) Have these hazards been identified in work that is being carried out?
- (iii) Has incident and injury data been reviewed?
- (iv) Has consultation with workers and their health and safety representatives occurred?
- (v) Is specialist or external assistance required?



Step 2 – Assess the risk of workplace injury and illness

- (i) How often does a hazard have the potential to cause harm?
- (ii) What type of injuries would the hazard cause?
- (iii) How serious are the injuries?
- (iv) Does the number and composition of workers and other people affect how first aid should be provided?
- (v) Could the size and location of the workplace affect how first aid is provided?

Step 3 – What first aid is required?

(a) First aiders

- (i) How many first aid helpers are needed?
- (ii) What competencies do they require?
- (iii) What training do they need?

(b) First aid kits and procedures

- (i) What kits or modules are needed and where should they be located?
- (ii) Is other first aid equipment needed?
- (iii) Who is responsible for maintaining the kits?
- (iv) What procedures are needed for my workplace?

(c) First aid facilities

- (i) Is a first aid room or health centre required?

Practical Exercises

Activity 1

Visit to Fire Station

Material required

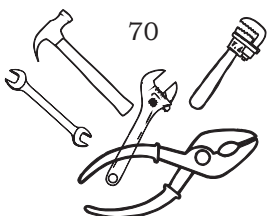
- 1. Copy
- 2. Pencil

Procedure

- 1. Fix an appointment with the Fire Station for a visit.
- 2. Reach the station as per schedule.
- 3. Discuss about all the safety tools, gadget and machines.
- 4. Do the handling and operating practice under the supervisor of fire station and teacher.

Activity 2

Drawing first aid equipment



Material required

1. First aid equipment
2. Tools
3. Drawing copy
4. Pencil
5. Rubber

Procedure

1. Select the fire safety equipment to be drawn.
2. Open the components with tools.
3. Draw the images of first aid equipment.

Activity 3

Draw the symbols and signs of safety at site

Material required

1. Pencil
2. Paper
3. Drawing sheet
4. Poster

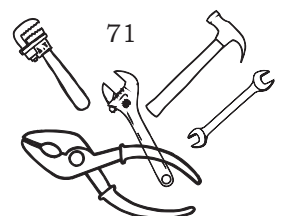
Procedure

1. Identify the symbols and signs.
2. Draw the images.
3. Also write the uses of these symbols.
4. Display these posters in the classroom.

Check Your Progress

A. Answer the following

1. Why is it important to comply with health and safety on site?
2. What general hygiene practices must be adhered at the workplace?
3. Why should the correct clothing, footwear and headgear be worn at all times?
4. Why is it important to maintain good personal hygiene?
5. What are the possible causes of fire in the working environment?
6. What preventive actions can be taken to minimise the risk of fire?
7. What organisational procedures should be followed in the event of a fire?
8. Why should a fire never be approached unless it is safe to do so?
9. What is the basic first aid that should be applied in the event of an accident?



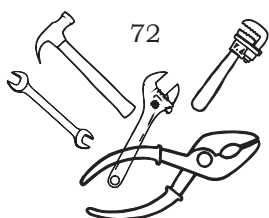
10. What action should be taken to ensure the safety of an injured and uninjured?
11. Why is it important to use the correct lifting techniques?
12. What are the employee's responsibilities in relation to health and safety regulations?

B. Multiple choice questions

1. Fall Hazard occurs when scaffoldings are erected _____.
 (a) improperly (b) properly
 (c) timely (d) None of these
2. Slips, trips and falls on stairways are a major source of injuries and fatalities among _____ workers.
 (a) construction (b) retail
 (c) automotive (d) None of these
3. Trench collapses cause dozens of fatalities and hundreds of injuries each _____.
 (a) year (b) month
 (c) time (d) None of these
4. Head can be protected by wearing the _____.
 (a) helmet (b) safety cap
 (c) gloves (d) None of these
5. Eye injuries can be prevented during work by wearing the _____.
 (a) safety glass
 (b) safety glass with side shield
 (c) cap
 (d) None of these

C. Fill in the blanks

1. Powered tools are used to _____ everyday tasks in the plumbing industry.
2. Hand tools can also be _____ if they are not used correctly.
3. Plumber work often involves significant _____ handling hazards.
4. Electric leads must be kept away from _____.
5. Heat stress, sunburn and skin cancer can all result from prolonged exposure to ultraviolet radiation from the _____.



Glossary

Guarded system: prevents the operator from having any part of their body in the danger zone during the operating cycle.

Landing: is the area of a floor near the top or bottom step of a stair. An intermediate landing is a small platform that is built as part of the stair between main floor levels and is typically used to allow stairs to change directions, or to allow the user a rest.

Risers: a vertical section between the treads of a staircase.

Scald: injury caused due to hot liquid or steam.

Shoring: is the construction of a temporary structure to support a temporarily unsafe structure. These support walls laterally.

Steps: stairs and steps share a single meaning. Both refer to a series of steps—those ‘structures consisting of a riser and a tread.’

Toe board: is a long piece of wood nailed horizontally along a roof in various places. The purpose of a toe board is to safeguard tools, equipment and objects that fall from the edge or is being pushed down from the structure.

Tread: a stair tread is the horizontal portion of a set of stairs on which a person walks.

Trench: a long, narrow ditch.

Answer Key

Units	Multiple choice questions	Fill in the blanks false
-------	------------------------------	-----------------------------

Unit 1: Pipes — Cutting, Threading, Joining and Testing of Pipelines

- | | |
|------|--------------------|
| 1. a | 1. bottom |
| 2. b | 2. pressure |
| 3. d | 3. thread per inch |
| 4. b | 4. 1/2, 2/3 |

Unit 2: Plumbing and Sanitary Fixtures

- | | |
|------|----------------|
| 1. c | 1. bowl shaped |
| 2. a | 2. legs |
| 3. a | 3. toilets |
| 4. a | 4. water |
| | 5. heating |

Unit 3: Basic Building Construction

- | | |
|------|---------|
| 1. c | water |
| 2. e | hole |
| 3. d | grooves |
| 4. d | fasten |
| 5. d | |

Unit 4: Pumps and their Installation

- | | |
|------|----------------------|
| 1. d | 1. Mechanical action |
| 2. c | 2. 25 |
| 3. a | 3. building |
| 4. d | 4. water |
| 5. a | 5. water meter |

Unit 5: Performing various Plumbing related Operations and Procedures

1. vitreous China
2. nominal
3. tap or faucet
4. main supply lines of water supply system and pipelines

Unit 6: Maintaining a Healthy, Safe and Secure Work Environment

- | | |
|------|--------------|
| 1. a | 1. carry out |
| 2. a | 2. dangerous |
| 3. a | 3. manual |
| 4. b | 4. water |
| 5. a | 5. sun |